Data Assimilation for Solar Occultation Studies – Further Development and Science Analysis

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- **To improve our data assimilation techniques for analysis of long-term solar occultation satellite data.**

- **Our own research with the data assimilation output has the following objectives:**

  - **To better understand processes controlling natural variability in the stratosphere and upper troposphere.**
  - **To quantify the contribution of chemistry and dynamics to past trends in stratospheric ozone and temperatures.**
  - **To improve predictions of future ozone layer changes.**

- **To make our data assimilation products freely available to the scientific community through a web site.**

Some Results from Smyshlyaev and Geller (JGR, 2001, 32,327-32,335)

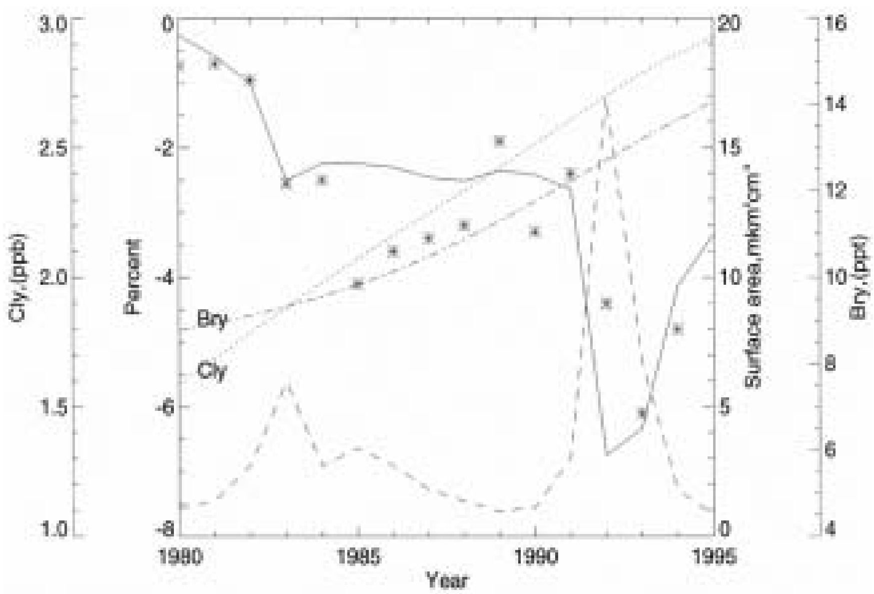

Figure 1. Extrapolar (from 65S-65N) year average column ozone trend (in percent to 1979): stars – TOMS, solid line – model assimilated SAGE II. Dashed line – aerosol surface area at 20 km (based on SAM II, SAGE I/II data), dotted line – chlorine mixing ratio at 40 km, dash-dotted line – bromine mixing ratio at 40 km (from Smyshlyaev and Geller, [2002])

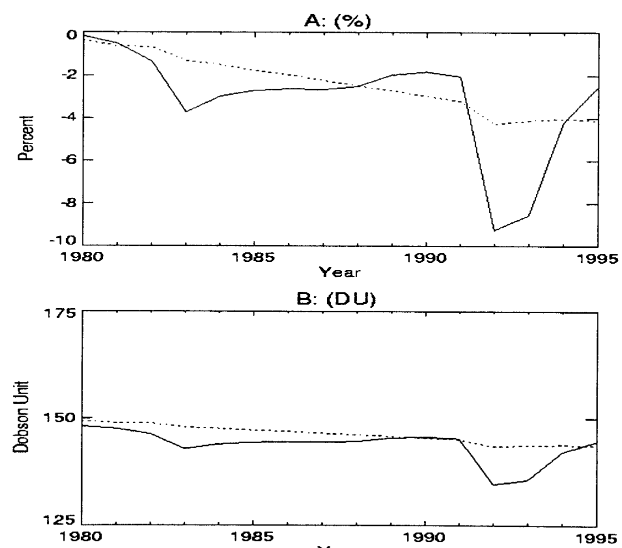

Figure 2. Tendencies of the height integrated ozone variability for 0-25 km (solid line) and 25-60 km (dotted line) in percent (top) and Dobson Units (bottom) (from *Smyshlyaev and Geller*, [2001]).

Some Unpublished Results from Smyshlyaev and Geller (when model includes the solar cycle)

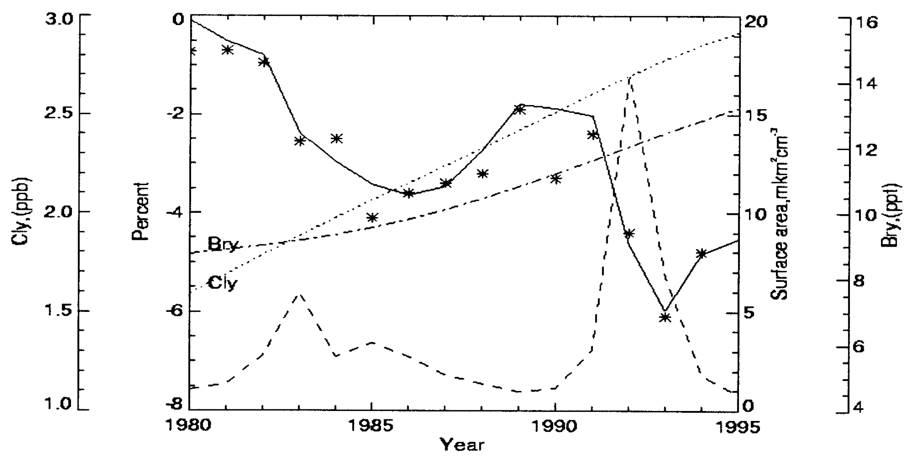

Figure 3. Results with the solar cycle included shown in the same manner as Fig. 1.

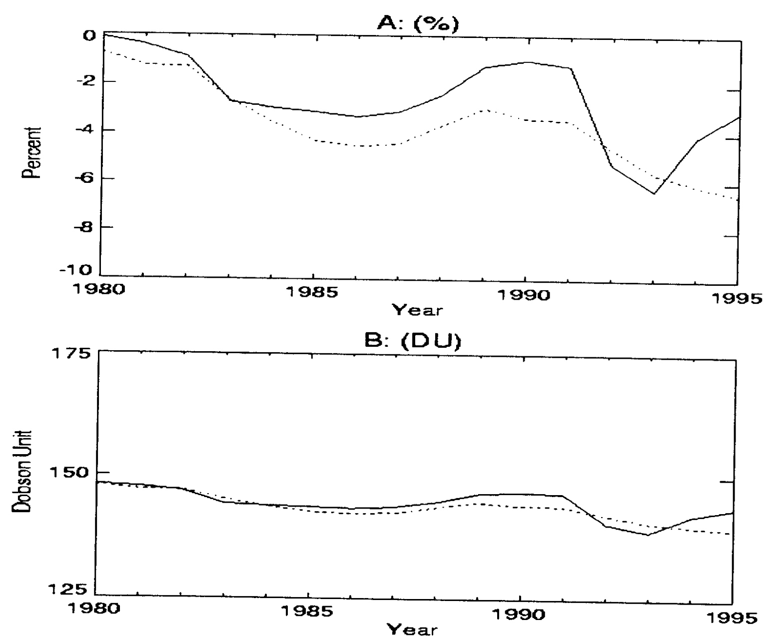

Figure 4. Results with the solar cycle included shown in the same manner as figure 2.

Some Results from Geller and Smyshlyaev (GRL, 2002, DOI 10.1029/2002GL015689)

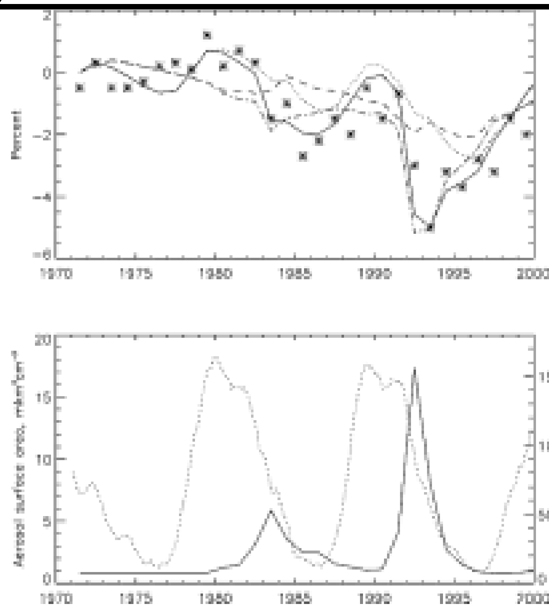

Figure 1. (Top) Modeled colume ozone, area averaged over 60S-60N. Dashed curve is for increasing chlorine and bromine only. Dotted curve is for the addition of the solar-cycle in UV radiation. Dot-dashed curve is for the addition of volcanic aerosol effects but without the solar cycle. Solid curve is for all effects. The stars show the averaged (annually and for different observational techniques) observations adapted from Fioletov et al. [2002]. (bottom) Dotted curve shows sunspot numbers. Solid curve shows aerosol surface area for 15-20 km.

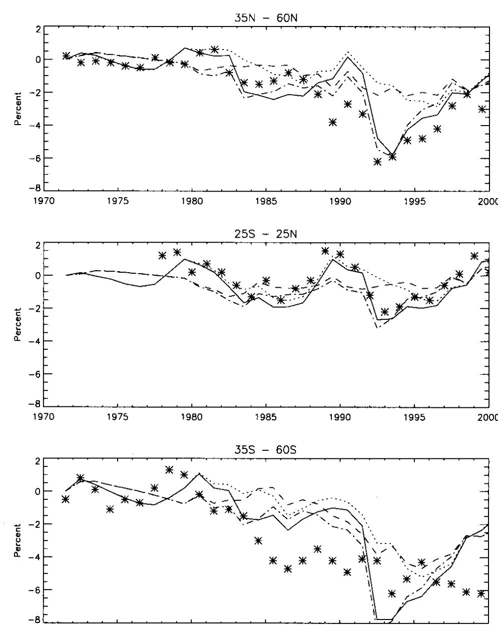

Figure 2. Modeled column ozone averaged over 35°N–60°N (top), 25°S–25°N (middle), and 35°S–60°S (bottom). Curves are labeled as in Figure 1. Stars – the averaged data adapted from *Fioletov et al.*, [2002].

1st Year

1. **Compare various SAGE II data assimilation results and choose the best strategy for choices for the influence region.**
2. **Define the best strategy for model/data relative weighting.**

2nd Year

1. **Study the relative role of volcanic aerosols and solar cycle on the observed long-term ozone trends.**
2. **Study the separate contributions of transport and chemistry effects on ozone evolution.**

3rd Year

1. **Extend our methodology to SAGE III, HALOE, and POAM.**
2. **Predict future ozone behavior using the improved model.**
3. **Continue diagnostic studies.**